CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] The glass substrate caused by chemical strengthening treatment at least The shape change of a peripheral edge part and/or an inner circumference end, The production method of the glass substrate for Information Storage Division media characterized by having the process which grasps a relation with chemical-strengthening-treatment conditions beforehand, and the process which performs chemical strengthening treatment to a glass substrate based on said relation.

[Claim 2] The glass substrate caused by chemical strengthening treatment at least The shape change of a peripheral edge part and/or an inner circumference end, The shape change of the peripheral edge part of the glass substrate by said chemical strengthening treatment and/or an inner circumference end is expected to be the process which grasps a relation with chemical-strengthening-treatment conditions beforehand. The process which obtains the glass substrate before the chemical strengthening treatment which determines the form of the peripheral edge part of the glass substrate before chemical strengthening treatment, and/or an inner circumference end, and has the form of this determined peripheral edge part and/or an inner circumference end, The production method of the glass substrate for Information Storage Division media characterized by performing chemical strengthening treatment to the glass substrate before the chemical strengthening treatment obtained above, and having the process which obtains the glass substrate after the chemical strengthening treatment which has a desired peripheral edge part and/or inner circumference end form.

[Claim 3] The production method of the glass substrate for Information Storage Division media according to claim 1 or 2 characterized by performing said chemical strengthening treatment on chemical-strengthening-treatment conditions with few shape changes of the peripheral edge part of a glass substrate, and/or an inner circumference end caused by said chemical strengthening treatment.

[Claim 4] The depth of the compressive stress layer which produces said chemical strengthening treatment on a glass substrate surface by chemical strengthening is set to 3-100 micrometers. The value of the compressive stress produced on a glass substrate surface by chemical strengthening becomes 1-

15kg/mm2. And the production method of the glass substrate for Information Storage Division media given in any 1 of the Claims 1-3 characterized by carrying out on the chemical-strengthening-treatment conditions from which the value of the tensile stress produced inside a glass substrate by chemical strengthening becomes 4.5kg/mm2 or less.

[Claim 5] The production method of the glass substrate for Information Storage Division media given in any 1 of the Claims 1-4 characterized by said chemical-strengthening-treatment conditions being the processing temperature and processing time in chemical strengthening treatment.

[Claim 6] It is the production method of the glass substrate for Information Storage Division media according to claim 5 characterized by for the range of said processing temperature being 280-400 degrees C, and the range of processing time being 0.5 to 5 hours.

[Claim 7] The relation between the main surface-lapping conditions of a glass substrate that beveling processing was performed, and the peripheral edge part of a glass substrate and/or inner circumference end form which are acquired by this main surface polish is grasped beforehand. The production method of the glass substrate for Information Storage Division media given in any 1 of the Claims 2-6 characterized by controlling the main surface-lapping conditions of a glass substrate based on this relation, and obtaining the glass substrate before said chemical strengthening treatment.

[Claim 8] The production method of the glass substrate for Information Storage Division media according to claim 7 characterized by the peripheral edge part and/or inner circumference end form of a glass substrate after polish making the main surface-lapping conditions of said glass substrate the polish conditions from which the bottom of a field will be in the state of ** to the main surface of a glass substrate.

[Claim 9] [said polish conditions from which the bottom of a field will be in the state of ** to the main surface of a glass substrate] The production method of the glass substrate for Information Storage Division media according to claim 8 characterized by being the conditions which make processed surface pressure to the glass substrate at the time of polish 40-150g/cm2 using the elasticity polisher of hardness 60-80 (Asker-C).

[Claim 10] Are the glass substrate for Information Storage Division media to which chemical strengthening treatment was performed, and the peripheral edge part and/or inner circumference end form of a glass substrate after chemical strengthening treatment set to the predetermined region of a peripheral edge part and/or an inner circumference end. The glass substrate for Information Storage Division media characterized by being the form which falls within the range of **0.35 micrometer by making the flat side on the surface of main of said glass substrate into a datum level (zero).

[Claim 11] In the field to the point in the recording area where it is the glass substrate for Information Storage Division media to which chemical strengthening treatment was performed, and the peripheral edge part form after chemical strengthening treatment separated from the peripheral edge of the glide field in the regular interval When the flat side of said glass substrate main surface is made into a datum level (zero), the value (Ski-jump (ski jumping) value) of a high point (Ski-jump (ski jumping) point) most within **0.35 micrometer And the glass substrate for Information Storage Division media according to claim 10 characterized by the value (Roll-Off (rolloff) value) of the peripheral edge position (Roll-Off (rolloff) point) of

the glide field at the time of making said flat side into a datum level being less than **0.35 micrometer.
[Claim 12] The depth of the compressive stress layer produced on the glass substrate surface by chemical strengthening is 3-100 micrometers. Claim 10 characterized by for the value of the compressive stress produced on the glass substrate surface by chemical strengthening being 1-15kg/mm2, and the value of the tensile stress produced inside the glass substrate by chemical strengthening being 4.5kg/mm2 or less, and the glass substrate for Information Storage Division media given in 11.
[Claim 13] The production method of the Information Storage Division medium characterized by having the process which forms a recording layer in the surface of the glass substrate for Information Storage Division media obtained by a method according to claim 1 to 9 at least.
[Claim 14] The Information Storage Division medium characterized by forming a magnetic layer in the surface of the glass substrate for Information Storage Division media according to claim 10 to 12 at least.
[Claim 15] The Information Storage Division medium according to claim 14 characterized by being the magnetic recording medium of a LUL (load unloading) method.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the glass substrate for Information Storage Division media which enables high-density record reproduction, Information Storage Division media, those production methods, etc.
[0002]
[Description of the Prior Art] As one of the Information Storage Division media carried in an information storage device, the magnetic disk carried in a hard disk (HDD) is known. In the magnetic disk, the request to improvement in storage capacity is strong, and amplification of recording area and high-density record-ization serve as pressing need in recent years.
[0003] It is necessary to secure the field where the main surface is smooth as widely as possible for amplification of recording area. However, ****** (field whom) in which a field falls to the main surface of a glass substrate in a substrate peripheral edge part according to the polish conditions of a glass substrate, If the floatation run of the magnetic head is carried out to the magnetic disk which the climax (henceforth upheaval) of a field to the main surface arises, and has such form Since the head inclined in the part of ****** or upheaval and the flight of the head became unstable, crash may be caused and the part of ****** or upheaval had become the obstacle of amplification of recording area. In order to solve these problems, by making the polish conditions (polishing work pressure and polishing work time) of a glass substrate into the predetermined range, an applicant for this patent develops the technology of suppressing upheaval etc. small, and is applying previously (JP,H5-89459,A). Moreover, in order to stabilize the flight of a head, the technology which specified the curvature showing ****** is proposed (JP,H5-290365,A).
[0004] It is required to consider it as the factor which enables high-density record on the other hand, and to

make the floatation height of the magnetic head to a magnetic disk as low as possible, and it is necessary to make the magnetic-disk surface into smoothness more for that purpose.

[0005] In recent years, even if it is the case where a magnetic disk becomes smooth, in order to prevent adsorption of a magnetic head, the magnetic head which attached the pad to the magnetic head, and development of a LUL (Load/Unload) method whose realization of low floatation height is attained are performed briskly. When in the case of this LUL method the magnetic-disk surface is smooth and the magnetic disk has usually stopped the magnetic head Since a magnetic head moves onto a disc face from the outside of a disk using a guide mechanism and record playback is performed after it is standing by on the outside of a magnetic disk and a magnetic disk rotates, generally as compared with a CSS method, it becomes a low floatation run. In the case of a LUL method, in order to secure the floatation stability of a magnetic head, it is necessary to control the peripheral edge part form of a substrate strictly compared with a CSS method. Since the low floatation run of a head is possible in the case of a LUL method, high-density record is attained compared with a CSS method.

[0006] In order to realize low floatation-ization of the magnetic head by a LUL method, the glass substrate excellent in flat nature and smoothness nature attracts attention as a substrate for magnetic disks. Usually, in order to raise the mechanical endurance of a glass substrate, chemical strengthening treatment which strengthens a glass substrate is performed by replacing some ion contained in a glass substrate surface with the ion in the chemical-strengthening-treatment liquid which has a bigger ionic radius than the ion.

[0007]

[Problem to be solved by the invention] However, [take / in the former / into consideration / the influence of chemical strengthening treatment] Or since it is not premised on performing chemical strengthening treatment, when a magnetic recording medium is produced using the glass substrate with which chemical strengthening treatment was performed, the peripheral edge part form of a substrate [a cause] The floatation run of the magnetic head became unstable, since a head crash occurred, low floatation-ization of the head could not be attained, and it became clear for amplification of recording area to also have been difficult. For this reason, there was a problem that realization of the magnetic recording medium of a LUL method was difficult, especially. In addition, also in a CSS method, it is desirable the peripheral edge part form of a substrate because of the floatation stability of a magnetic head, and amplification of recording area. Moreover, there is a problem that per [which fixes a magnetic disk] clamp, and a magnetic disk will incline also in the inner circumference end of a substrate if there is upheaval etc., or it is distorted and fixed, there is a problem which a crack generates when the mechanical intensity of a substrate is weak, and to also control the inner circumference end form of a substrate is desired.

[0008] This invention is made under an above-mentioned background, and offer of the production method of the glass substrate for Information Storage Division media which can obtain the glass substrate after the chemical strengthening treatment which has desired peripheral edge part form and/or inner circumference end form etc. is set as the first purpose. Moreover, offer of the Information Storage Division medium which it has sufficient smoothness for a grade recordable high-density, and can expand recording area even to a

periphery is set as the second purpose, having the mechanical endurance by chemical strengthening.
[0009]
[Means for solving problem] [the ion of a glass surface] by being exchanged for the ion which has a bigger ionic radius if this invention persons perform chemical strengthening treatment to a glass substrate wholeheartedly as a result of investigation It traces that elongation carries out a certain quantity development and the form (edge profile: Edge Profile) of the peripheral edge part of a substrate and/or an inner circumference end changes to a glass substrate. Owing to, it became unstable floatation running the shape change of the peripheral edge part generated especially by this chemical strengthening treatment of the magnetic head, since a head crash occurred, low floatation-ization of the head could not be attained, and amplification of recording area traced that it was difficult. Since elongation specifically occurs in the direction of an arrow by chemical strengthening treatment in the peripheral edge part and/or inner circumference end of the glass substrate 1 as shown in drawing 6 (a), the upheaval 5 as shown near the boundary of the main surface 2 and the chamfering-of-the-edge part 3 at drawing 6 (b) is produced. In addition, although upheaval arises similarly near the boundary of the chamfering-of-the-edge part 3 and the side wall part 4, this upheaval does not usually pose a problem in the relation on a head or the surface of main.
[0010] And as a result of repeating investigation further, it found out that the shape change of the peripheral edge part of a glass substrate and/or an inner circumference end caused by chemical strengthening treatment could be controlled by chemical-strengthening-treatment conditions in the first place. Moreover, it found out to the second that the peripheral edge part form and/or inner circumference end form of a glass substrate before chemical strengthening treatment could be controlled by the main surface-lapping conditions of a glass substrate that beveling processing was performed. And it finds out that the glass substrate after the chemical strengthening treatment which has desired peripheral edge part form and/or inner circumference end form is obtained by using these, and came to complete the first invention. Moreover, by making peripheral edge part form of the glass substrate after chemical strengthening treatment into the form by which the predetermined numerical range is fulfilled It finds out that a floatation run of a magnetic head can be stabilized, low floatation-ization of a head can be attained, without causing a head crash, and amplification of recording area can be aimed at, and that especially these things are very effective about the magnetic recording medium of a LUL method, and came to complete the second invention.
[0011] This invention has the following composition.
[0012] The glass substrate caused by chemical strengthening treatment at least The shape change of a peripheral edge part and/or an inner circumference end, (Composition 1) The production method of the glass substrate for Information Storage Division media characterized by having the process which grasps a relation with chemical-strengthening-treatment conditions beforehand, and the process which performs chemical strengthening treatment to a glass substrate based on said relation.
[0013] The glass substrate caused by chemical strengthening treatment at least The shape change of a

peripheral edge part and/or an inner circumference end, (Composition 2) The shape change of the peripheral edge part of the glass substrate by said chemical strengthening treatment and/or an inner circumference end is expected to be the process which grasps a relation with chemical-strengthening-treatment conditions beforehand. The process which obtains the glass substrate before the chemical strengthening treatment which determines the form of the peripheral edge part of the glass substrate before chemical strengthening treatment, and/or an inner circumference end, and has the form of this determined peripheral edge part and/or an inner circumference end, The production method of the glass substrate for Information Storage Division media characterized by performing chemical strengthening treatment to the glass substrate before the chemical strengthening treatment obtained above, and having the process which obtains the glass substrate after the chemical strengthening treatment which has a desired peripheral edge part and/or inner circumference end form.

[0014] (Composition 3) The production method of the glass substrate for Information Storage Division media the composition 1 to which the shape change of the peripheral edge part of a glass substrate and/or an inner circumference end caused by said chemical strengthening treatment is characterized by performing said chemical strengthening treatment on few chemical-strengthening-treatment conditions, or given in 2.

[0015] The depth of the compressive stress layer which produces said chemical strengthening treatment on a glass substrate surface by chemical strengthening is set to 3-100 micrometers. (Composition 4) The value of the compressive stress produced on a glass substrate surface by chemical strengthening becomes 1-15kg/mm2. And the production method of the glass substrate for Information Storage Division media given in any 1 of the composition 1 to 3 of that the value of the tensile stress produced inside a glass substrate by chemical strengthening is characterized by carrying out on the chemical-strengthening-treatment conditions used as 4.5kg/mm2 or less.

[0016] (Composition 5) The production method of the glass substrate for Information Storage Division media given in any 1 of the composition 1 to 4 of that it is characterized by said chemical-strengthening-treatment conditions being the processing temperature and processing time in chemical strengthening treatment.

[0017] (Composition 6) It is the production method of the glass substrate for Information Storage Division media of the composition 5 description characterized by for the range of said processing temperature being 280-400 degrees C, and the range of processing time being 0.5 to 5 hours.

[0018] The main surface-lapping conditions of a glass substrate that beveling processing was performed, (Composition 7) Grasp beforehand the relation with the peripheral edge part of a glass substrate and/or inner circumference end form which are acquired by this main surface polish, and the main surface-lapping conditions of a glass substrate are controlled based on this relation. The production method of the glass substrate for Information Storage Division media given in any 1 of the composition 2 to 6 of that it is characterized by obtaining the glass substrate before said chemical strengthening treatment.

[0019] (Composition 8) The production method of the glass substrate for Information Storage Division media of the composition 7 description characterized by the peripheral edge part and/or inner circumference end form of a glass substrate after polish making the main surface-lapping conditions of said glass substrate the

polish conditions from which the bottom of a field will be in the state of ** to the main surface of a glass substrate.

[0020] (Composition 9) [said polish conditions from which the bottom of a field will be in the state of ** to the main surface of a glass substrate] The production method of the glass substrate for Information Storage Division media of the composition 8 description characterized by being the conditions which make processed surface pressure to the glass substrate at the time of polish 40-150g/cm2 using the elasticity polisher of hardness 60-80 (Asker-C).

[0021] Are the glass substrate for Information Storage Division media to which chemical strengthening treatment was performed, and the peripheral edge part and/or inner circumference end form of a glass substrate after chemical strengthening treatment set to the predetermined region of a peripheral edge part and/or an inner circumference end. (Composition 10) The glass substrate for Information Storage Division media characterized by being the form which falls within the range of **0.35 micrometer by making the flat side on the surface of main of said glass substrate into a datum level (zero).

[0022] In the field to the point in the recording area where it is the glass substrate for Information Storage Division media to which chemical strengthening treatment was performed, and the peripheral edge part form after chemical strengthening treatment separated from the peripheral edge of the glide field in the regular interval (Composition 11) When the flat side of said glass substrate main surface is made into a datum level (zero), the value (Ski-jump (ski jumping) value) of a high point (Ski-jump (ski jumping) point) most within **0.35 micrometer And the glass substrate for Information Storage Division media given in the composition 10 characterized by the value (Roll-Off (rolloff) value) of the peripheral edge position (Roll-Off (rolloff) point) of the glide field at the time of making said flat side into a datum level being less than **0.35 micrometer.

[0023] The depth of the compressive stress layer produced on the glass substrate surface by chemical strengthening is 3-100 micrometers. (Composition 12) The composition 10 characterized by for the value of the compressive stress produced on the glass substrate surface by chemical strengthening being 1-15kg/mm2, and the value of the tensile stress produced inside the glass substrate by chemical strengthening being 4.5kg/mm2 or less, and the glass substrate for Information Storage Division media given in 11.

[0024] (Composition 13) The production method of the Information Storage Division medium characterized by having the process which forms a recording layer in the surface of the glass substrate for Information Storage Division media obtained by the method of a description by either of the composition 1 to 9 at least.

[0025] (Composition 14) The Information Storage Division medium characterized by forming a magnetic layer in the surface of the glass substrate for Information Storage Division media given in either of the composition 10 to 12 at least.

[0026] (Composition 15) The Information Storage Division medium of the composition 14 description characterized by being the magnetic recording medium of a LUL (load unloading) method.

[0027]

[Function] According to composition 1, the relation of the shape change (especially variation of the thickness

direction of a glass substrate) of the peripheral edge part of a glass substrate and chemical-strengthening-treatment conditions which are caused by chemical strengthening treatment is grasped beforehand. By performing chemical strengthening treatment of a glass substrate based on this relation, it becomes possible to control the shape change of the peripheral edge part of the glass substrate caused by chemical strengthening treatment by chemical-strengthening-treatment conditions. In addition, these things are the same also about the inner circumference end of a glass substrate. [some ion contained in a glass substrate surface] as chemical strengthening treatment The chemical-strengthening-treatment method by the ion exchange which performs chemical strengthening by replacing with the ion in the chemical-strengthening-treatment liquid which has a bigger ionic radius than the ion, The chemical-strengthening-treatment method by the dealkalization processing which performs chemical strengthening etc. is mentioned by removing the alkali ion contained in a glass substrate surface. In the case of the chemical-strengthening-treatment method by ion exchange, since elongation occurs in the field inboard of a glass substrate, the amount of shape changes to the main surface becomes a forward value (upheaving direction). Since a glass substrate is shrunken by field inboard in the case of the chemical-strengthening-treatment method by dealkalization processing, the amount of shape changes to the main surface becomes a negative value (the direction of page ****). The amount of shape changes of the inner circumference end of a glass substrate is small ten percent - about twenty percent compared with the amount of shape changes of a peripheral edge part.

[0028] According to composition 2, in addition to the effect of composition 1, it counts upon the shape change of the peripheral edge part of the glass substrate by chemical strengthening treatment. By using the glass substrate before the chemical strengthening treatment which has the shape change of the peripheral edge part which may offset the shape change of the peripheral edge part by this chemical strengthening treatment, it becomes more strictly possible about the form of the peripheral edge part of the glass substrate after chemical strengthening treatment to control in desired form. In addition, these things are the same also about the inner circumference end of a glass substrate.

[0029] By performing chemical strengthening treatment on chemical-strengthening-treatment conditions with few [according to composition 3] shape changes of the peripheral edge part of the glass substrate caused by chemical strengthening treatment For example, if the peripheral edge part of the glass substrate before chemical strengthening treatment is flat, it is possible to suppress the shape change of the peripheral edge part of the glass substrate caused by chemical strengthening treatment few. Moreover, even if it is the case where the glass substrate before the chemical strengthening treatment which has the shape change of the peripheral edge part which may offset the shape change of the peripheral edge part of the glass substrate by chemical strengthening treatment is used for composition 2 like a description for example Since the shape change of the peripheral edge part of the glass substrate before and behind chemical strengthening treatment is small, compared with the case where it is accompanied by a big shape change, it is easy to control peripheral edge part form, and the variation in a shape change is excellent in the field of the stability of processing few. In addition, these things are the same also about the inner circumference end of a glass substrate.

[0030] The amount of shape changes of the peripheral edge part when moreover performing chemical strengthening treatment can be stopped low, having the mechanical intensity of a desirable glass substrate by the compressive stress layer depth produced on a glass substrate surface by chemical strengthening in the first place being 3-100 micrometers according to composition 4. when the depth of a compressive stress layer is less than 3 micrometers, the intensity of a glass substrate becomes weak (the endurance over a blemish --) Since the amount of shape changes of the peripheral edge part when performing chemical-strengthening place processing becomes large when destructive-proof characteristics exceed 100 micrometers preferably by that deteriorating, and it becomes difficult to control peripheral edge part form, it is not desirable. The depth of a desirable compressive stress layer is 40-80 micrometers, and is 50-70 micrometers more preferably. The intensity of a glass substrate and the endurance over breakage with the passage of time can be raised by the value of the compressive stress produced [second] on a glass substrate surface by chemical strengthening being 1-15kg/mm2, and the value of the tensile stress produced inside a glass substrate by chemical strengthening being 4.5kg/mm2 or less. ** (the endurance over a blemish --) to which the intensity of a glass substrate becomes weak when the value of compressive stress is less than 1kg/mm2 Since the amount of shape changes of the peripheral edge part when performing chemical strengthening treatment becomes large when destructive-proof characteristics exceed 15kg/mm2 preferably by that deteriorating, and it becomes difficult to control peripheral edge part form, it is not desirable. Moreover, since the amount of shape changes of the peripheral edge part when performing chemical strengthening treatment becomes large when the value of tensile stress exceeds 4.5kg/mm2, and it becomes difficult to control peripheral edge part form, it is not desirable. The depth of a compressive stress layer produced on a glass substrate surface by chemical strengthening more preferably 40-80 micrometers, The value of the tensile stress which the value of the compressive stress produced on a glass substrate surface by chemical strengthening produces inside a glass substrate by 3-14kg/mm2 and chemical strengthening is desirable in respect of control of the chemical-strengthening-treatment conditions used as 2.5kg/mm2 or less of the mechanical intensity of a glass substrate, and end form. In addition, the above-mentioned effect becomes still more remarkable by making the optimal balance the depth of a compressive stress layer, a compressive stress value, and a **** stress value. In addition, these things are the same also about the inner circumference end of a glass substrate.

[0031] According to composition 5, it becomes possible easily to stop the amount of shape changes of the peripheral edge part of the glass substrate by chemical strengthening treatment and/or an inner circumference end within the limits of predetermined by carrying out the processing temperature and processing time which are chemical-strengthening-treatment conditions predetermined within the limits. In addition, although there are conditions other than processing temperature and processing time, such as a kind of fused salt and its mixing ratio, as chemical-strengthening-treatment conditions, among these, compared with the kind and the mixing ratio of fused salt, processing temperature and processing time can be adjusted easily, therefore are effective conditions from a viewpoint of mass production nature or workability.

[0032] As shown in composition 6, as for concrete chemical-strengthening-treatment conditions, it is desirable to make processing temperature into the range of 280-400 degrees C, and to make processing time into the range of 0.5 to 5 hours. Since below the melting point of fused salt becomes when processing temperature is less than 280 degrees C, when exceeding 400 degrees C preferably, since processing time becomes short and workability worsens, it is not desirable. Moreover, since workability worsens in the case of less than 0.5 hour, when exceeding 5 hours preferably, since productivity worsens, processing time is not desirable. [in addition, a desirable processing temperature and processing time] from a viewpoint which stops low the amount of shape changes of the peripheral edge part of the glass substrate by chemical strengthening treatment, and/or an inner circumference end Since it changes with composition of a glass substrate, composition of chemical-strengthening-treatment liquid, etc., it cannot generally say, but it is desirable to make 320-380 degrees C of processing temperature into the range of 340-360 degrees C for processing temperature preferably, and to make processing time into the range of 1 to 4 hours for example.

[0033] The main surface-lapping conditions of a glass substrate that beveling processing was performed according to composition 7, By grasping beforehand the relation with the peripheral edge part form of a glass substrate and/or inner circumference end form which are acquired by the main surface polish, and controlling the main surface-lapping conditions of a glass substrate based on this relation It becomes possible to be easy and highly precise and to obtain the glass substrate before the chemical strengthening treatment which has desired peripheral edge part form and/or inner circumference end form.

[0034] [according to composition 8 / the main surface-lapping conditions of a glass substrate / the peripheral edge part form of the glass substrate after polish] when the bottom of a field considers it as the polish conditions which will be in the state of ** to the main surface 2 of the glass substrate 1 as shown in drawing 1 It becomes possible to be easy and highly precise and to obtain the glass substrate before the chemical strengthening treatment which has the peripheral edge part form which may offset the shape change of the peripheral edge part by chemical strengthening treatment. In addition, these things are the same also about the inner circumference end of a glass substrate.

[0035] [according to composition 9] by the processed surface pressure to the glass substrate at the time of polish being 40-150g/cm2 using the elasticity polisher of hardness 60-80 (Asker-C) It becomes possible to be easy and highly precise and to obtain the glass substrate before the chemical strengthening treatment which has the peripheral edge part form where the bottom of a field is in the state of **, to the main surface of a glass substrate. Moreover, control of peripheral edge part form is easy. In addition, if other polish conditions are the same, there is a tendency for the bottom of a field to become ****** in peripheral edge part form as hardness of a polisher (scouring pad) is hardened. Moreover, there is a tendency for peripheral edge part form to turn into upheaval form as processed surface pressure becomes high. Furthermore, there is a tendency for the bottom of a field to become ****** in peripheral edge part form, so that peripheral speed is early. In addition, peripheral edge part form changes with polish conditions, such as structure of polish equipment, a size, and an amount of abrasive powder, and control of the peripheral edge part form by the hardness of a polisher has good controllability, and is easy to control, and its controllable width is also large.

Therefore, it is desirable for it to be mainly concerned with control of the peripheral edge part form by the hardness of a polisher, and to sub** control of the peripheral edge part form by processed surface pressure or peripheral speed. These things are the same also about the inner circumference end of a glass substrate.

[0036] According to composition 10, the peripheral edge part form of the glass substrate after chemical strengthening treatment is set to the predetermined region of a peripheral edge part. By considering it as the form which falls within the range (-0.35 micrometer - +0.35 micrometer) of **0.35 micrometer by making the flat side on the surface of main of said glass substrate into a datum level (zero) A floatation run of a magnetic head can be stabilized, low floatation-ization (high-density record reproduction) of a head can be attained, without causing a head crash, and amplification of recording area can be aimed at. That is, the flat nature of the grade which interferes with neither amplification of recording area nor high-density record-ization is obtained about the peripheral edge part form of the glass substrate after chemical strengthening treatment. For this reason, it is very effective to the magnetic recording medium of a LUL method especially. In addition, although the predetermined region of a peripheral edge part can be appointed arbitrarily, when the flat side of the field where flat nature is spoiled in a peripheral edge part, i.e., the main surface of a glass substrate, is made into a datum level, it is desirable that the gap from a datum level makes a large field a predetermined region. Specifically, the field from the peripheral edge of recording area (area which the flat nature on the surface of main makes usually secure) to the peripheral edge of a glide field can be appointed at a predetermined region, for example. Moreover, for example, the field from the side wall part of a substrate to the inside [peripheral edge / of recording area] can also be appointed at a predetermined region. As for peripheral edge part form, it is desirable to make less than (-0.20-0.20 micrometer) **0.20 micrometer into the form which falls within the range of less than (-0.10-0.10 micrometer) **0.10 micrometer to a datum level still more preferably to a datum level more preferably. In addition, these things are the same also about the inner circumference end of a glass substrate.

[0037] In the field to the point in the recording area where the peripheral edge part form after chemical strengthening treatment separated [according to composition 11] from the peripheral edge of the glide field in the regular interval When the flat side of the glass substrate main surface is made into a datum level (zero), the value (Ski-jump value) of a high point (Ski-jump point) most within **0.35 micrometer And while the effect of composition 10 is acquired by supposing that the value (Roll-Off value) of the peripheral edge position (Roll-Off point) of the glide field at the time of making said flat side into a datum level considers it as the form which is less than **0.35 micrometer The product control in a manufacturing process becomes easy by performing numerical administration paying attention to datum points, such as a Ski-jump point and a Roll-Off point. A Ski-jump value means the value of the highest point (Ski-jump point) when peripheral edge part form of a substrate is based on the flat side on the surface of main of a glass substrate here. A Roll-Off value means the value of the border line top point (Rol1-Off point) in the peripheral edge position of the glide field at the time of making said flat side into a datum level. It is measured as follows in detail. As shown in drawing 2 , it passes along the center of a disc-like glass substrate, and the section which cut the glass

substrate in respect of being vertical to the main surface is considered. In this section, the datum point of two points is set up in the recording area on the border line on the surface of main, and it is referred to as RI and R2 from the center at near order. Moreover, the point R3 (peripheral edge position of a glide field) of having taken the margin of a still more nearly fixed distance to a peripheral direction from the peripheral edge part of recording area is set up. Next, Point RI and a point R2 are connected and the extension is drawn. Such at the time, the point on the border line of a substrate and the distance of straight line R1R2 (or the extension) are measured in the field from a point R2 to a point R3. The point S on the border line of the substrate of the place in a forward direction where the distance is the highest is a Ski-jump (ski jumping) point, and the value of the distance s is a Ski-jump value. Moreover, the border line top point R in the position of a point R3 is a Roll-Off (rolloff) point, and the distance r of Point R and straight line R1R2 (or the extension) is a Roll-Off value. In addition, as shown in drawing 3 , a Ski-jump value may be subtracted a little, and, as for Ski-jump, the bottom of a field shows ** in this case. Moreover, as shown in drawing 4 , a Roll-Off value may be added and Roll-Off shows upheaval of a field in this case. In addition, drawing 4 is the case where a Ski-jump value and a Roll-Off value are in agreement.

[0038] In addition, according to the size of a substrate, the point RI describing above, R2, and R3 are chosen suitably. For example, when it is the substrate whose outer diameter size is 2.5 inches, 3.0 inches, and 3.5 inches, R3 point is provided in the position of 1mm inside from the side wall side (side wall part) of a substrate. Moreover, when outer diameter size is a 2.5 inches (outer diameter 65mmphi) substrate, the distance from the center of a substrate can set like a 23mm point (R1), a 27mm point (R2), a 31.5mm point (R3), and a 32.5mm point (side wall side), respectively.

[0039] When exceeding the range whose Ski-jump value is -0.35micrometer-+0.35micrometer, since the floatation stability of a magnetic head worsens, a head crash occurs when severe, and it becomes impossible to carry in a magnetic disk drive, it is not desirable. Moreover, when exceeding the range whose Roll-Off value is -0.35micrometer-0.35micrometer, since the floatation stability of a magnetic head worsens, a head crash occurs like **** when severe, and it becomes impossible to carry in a magnetic disk drive, it is not desirable.

[0040] A more desirable Ski-jump value and less than (-0.20-0.20 micrometer) **0.20 micrometer of Roll-Off values are less than (-0.10-0.10 micrometer) **0.10 micrometers still more preferably, respectively.

[0041] According to composition 12, the glass substrate for Information Storage Division media which has the mechanical intensity of a desirable glass substrate is obtained by the compressive stress layer depth produced by chemical strengthening in the first place at a glass substrate surface being 3-100 micrometers. when the depth of a compressive stress layer is less than 3 micrometers, the intensity of a glass substrate becomes weak (the endurance over a blemish --) When destructive-proof characteristics exceed 100 micrometers preferably by that deteriorating, since the substrate which has good peripheral edge part form by the amount of shape changes at the time of performing chemical-strengthening place processing becoming large is not obtained, it is not desirable. The depth of a desirable compressive stress layer is 40-80 micrometers, and is 50-70 micrometers more preferably. When the value of the compressive stress

produced [second] on a glass substrate surface by chemical strengthening considers it as 1-15kg/mm2 and the value of the tensile stress produced inside a glass substrate by chemical strengthening considers it as 4.5kg/mm2 or less, since the intensity of a glass substrate and the endurance over breakage with the passage of time improve, it is desirable. ** (the endurance over a blemish --) to which the intensity of a glass substrate becomes weak when the value of compressive stress is less than 1kg/mm2 When destructive-proof characteristics exceed 15kg/mm2 preferably by that deteriorating, since the substrate which has good peripheral edge part form by the amount of shape changes at the time of performing chemical strengthening treatment becoming large is not obtained, it is not desirable. Moreover, when the value of tensile stress exceeds 4.5kg/mm2, since the substrate which has good peripheral edge part form by the amount of shape changes at the time of performing chemical strengthening treatment becoming large is not obtained, it is not desirable. The depth of a compressive stress layer produced on a glass substrate surface by chemical strengthening more preferably 40-80 micrometers, The value of the tensile stress which the value of the compressive stress produced on a glass substrate surface by chemical strengthening produces inside a glass substrate by 3-14kg/mm2 and chemical strengthening is desirable in respect of control of the chemical-strengthening-treatment conditions used as 2.5kg/mm2 or less of the mechanical intensity of a glass substrate, and end form. In addition, the above-mentioned effect becomes still more remarkable by making the optimal balance the depth of a compressive stress layer, a compressive stress value, and a **** stress value.

[0042] According to composition 13, the peripheral end face form of a glass substrate is flat, and the Information Storage Division medium to which recording area is expandable is obtained. Moreover, inner circumference end face form can be flat, the crack of a substrate can be prevented, and a magnetic storage device can be correctly equipped with the Information Storage Division medium.

[0043] According to composition 14, the peripheral end face form of a glass substrate is flat, recording area can be expanded and a magnetic recording medium recordable high-density is obtained. Moreover, inner circumference end face form can be flat, the crack of a substrate can be prevented, and a magnetic storage device can be correctly equipped with the Information Storage Division medium.

[0044] Like composition 15, the effect is most demonstrated by applying this invention to the magnetic recording medium of the LUL (load unloading) method in which the reduction in super-floatation of a magnetic head is possible.

[0045]

[Mode for carrying out the invention] (Work example 1) It asked for the relation between the thickness of compressive stress layers, such as variation of chemical-strengthening-treatment conditions and the peripheral edge part form of a substrate, and variation of the outer diameter and bore of a substrate, a compressive stress value, a tensile stress value, and the anti-chip box intensity of a substrate in the work example 1.

[0046] After end-face mirror polishing, two or more glass substrates of the diameter (95mmphi) of 3.5 inch by which precision polish (polishing) was carried out in the main surface, and the diameter (65mmphi) of 2.5

inch are prepared. The bore, the amount of outside diameter changes, and Ski-jump value of the substrate when changing chemical-strengthening-treatment conditions (consolidation temperature, consolidation time) were measured. In addition, the substrate peripheral edge part before chemical strengthening treatment used the almost flat substrate (therefore, both a Ski-jump value and a Roll-Off value are zero mostly). Moreover, in the case of the diameter of 2.5 inch, R3 point was defined inside from the side wall side 4 in the position (position whose distance from the center of a substrate is 31.5mm) of 1mm, and R2 point was defined inside from the side wall side 4 in the position (position whose distance from the center of a substrate is 27mm) of 5.5mm. In the case of the diameter of 3.5 inch, R3 point was defined inside from the side wall side 4 in the position (position whose distance from the center of a substrate is 46.5mm) of 1mm, and R2 point was defined inside from the side wall side 4 in the position (position whose distance from the center of a substrate is 42mm) of 5.5mm (drawing 2). And the Ski-jump value was made into the measured value which serves as a high point most in the field between point R2R3, and Ski-jump variation was calculated from the difference of the Ski-jump value before and behind chemical strengthening treatment. The Ski-jump value was measured with the surface roughness measuring instrument (surfboard test SV-624: made by MITTOYO). Moreover, the bore and the amount of outside diameter changes of a substrate are the values which calculated the bore and outside diameter size difference of the substrate before and behind chemical strengthening treatment, and the diameter of inside and outside of the substrate was measured with the micro meter. What mixed potassium nitrate (60wt%) and sodium nitrate (40wt%) was used for chemical-strengthening solution. The result about the substrate of the diameter of 3.5 inch is shown in Table 1, and the result about the substrate of the diameter of 2.5 inch is shown in Table 2.

[0047]

[Table 1]

(1) 3．5インチ径

	強化温度	強化時間	外径変化量	内径変化量	Ski-jump変化量
試料1－1	340℃	1.5hr	0.020mm	0.006mm	0
試料1－2	340℃	2hr	0.024mm	0.009mm	0.004μm
試料1－3	360℃	1.5hr	0.027mm	0.009mm	0.008μm
試料1－4	360℃	2hr	0.031mm	0.008mm	0.010μm
試料1－5	380℃	1.5hr	0.034mm	0.010mm	0.012μm
試料1－6	380℃	2hr	0.039mm	0.011mm	0.030μm
試料1－7	380℃	4hr	0.056mm	0.015mm	0.035μm

	応力層厚さ	圧縮応力	引張応力	抗折強度
試料1－1	75.1μm	13.8kg／mm²	2.0kg／mm²	30.0kgf
試料1－2	79.8μm	13.8kg／mm²	2.0kg／mm²	30.4kgf
試料1－3	79.8μm	13.7kg／mm²	2.5kg／mm²	31.4kgf
試料1－4	84.5μm	13.9kg／mm²	2.6kg／mm²	32.6kgf
試料1－5	93.9μm	14.0kg／mm²	2.6kg／mm²	33.8kgf
試料1－6	112.7μm	14.5kg／mm²	2.6kg／mm²	35.7kgf
試料1－7	140.8μm	20.5kg／mm²	2.7kg／mm²	35.8kgf

[Table 2]
(2) 2.5インチ径

	強化温度	強化時間	外径変化量	内径変化量	Ski-jump変化量
試料2－1	340℃	0.6hr	0.010mm	0.002mm	0.000μm
試料2－2	340℃	1.5hr	0.025mm	0.007mm	0.002μm
試料2－3	340℃	2hr	0.028mm	0.006mm	0.002μm
試料2－4	360℃	1.5hr	0.029mm	0.009mm	0.004μm
試料2－5	360℃	2hr	0.030mm	0.009mm	0.006μm
試料2－6	380℃	1.5hr	0.034mm	0.012mm	0.012μm
試料2－7	380℃	2hr	0.036mm	0.013mm	0.020μm
試料2－8	380℃	4hr	0.040mm	0.015mm	0.040μm

	応力層厚さ	圧縮応力	引張応力	抗折強度
試料2－1	40.2μm	6.2kg／mm²	0.9kg／mm²	10.3kgf
試料2－2	56.3μm	10.9kg／mm²	1.6kg／mm²	22.2kgf
試料2－3	70.4μm	11.1kg／mm²	2.0kg／mm²	22.6kgf
試料2－4	75.1μm	11.8kg／mm²	2.0kg／mm²	25.2kgf
試料2－5	84.5μm	13.6kg／mm²	2.7kg／mm²	25.3kgf
試料2－6	84.5μm	14.2kg／mm²	3.85kg／mm²	26.4kgf
試料2－7	84.5μm	15.3kg／mm²	4.1kg／mm²	24.5kgf
試料2－8	131.4μm	20.2kg／mm²	5.35kg／mm²	23.8kgf

[0048] It turned out that chemical-strengthening conditions follow for becoming strong (the stress to which the consolidation time when temperature becomes high becomes long becoming large) as the above-mentioned result shows, the outer diameter and bore variation of a substrate become large, and Ski-jump variation also becomes large. Therefore, the consolidation conditions which determined chemical-strengthening-treatment conditions and were searched for above within limits which satisfy mechanical and chemical durability required of the glass substrate for magnetic disks, From a correlation with Ski-jump variation, the amount of Ski-jump caused by chemical-strengthening-treatment conditions is expected. Control of strict end form is attained by making end form before chemical strengthening treatment into predetermined end form by double lump of a lapping process and a polishing process. [in addition, anti-chip box intensity required in order to use it as a glass substrate for magnetic disks] [in the case of the diameter of 3.5 inch / what / is been about 15-20 kgf (therefore, a sample 1-1 to 1-7 all has sufficient anti-chip box intensity)] [Ski-jump variation / few (0-0.010 micrometer) chemical-strengthening conditions (340-360 degrees C, 1.5 - 2hr)] When carrying out chemical strengthening treatment suppresses small change of the peripheral edge part form of a glass substrate, it turns out that it is good, and it turns out that chemical-strengthening conditions (340 degrees C, 1.5 - 2hr) with less (0-0.004 micrometer) Ski-jump variation are more desirable. [moreover, anti-chip box intensity required / the same may be said of the case of the diameter of 2.5 inch, and / in order to use it as a glass substrate for magnetic disks] Since it is about 10-15

kgf (therefore, a sample 2-1 to 2-8 all has sufficient anti-chip box intensity), it turns out that chemical-strengthening conditions (340-360 degrees C, 0.6 - 2hr) with little (0-0.004 micrometer) Ski-jump variation are more desirable. [the more desirable chemical-strengthening-treatment conditions for there being few amounts of end shape changes (Ski-jump variation), and satisfying mechanical intensity from the above result,] The depth of a compressive stress layer produced on a glass substrate surface by chemical strengthening 40-80 micrometers, It can say from the above-mentioned result that the value of the tensile stress which the value of the compressive stress produced on a glass substrate surface by chemical strengthening produces inside a glass substrate by 3-14kg/mm2 and chemical strengthening is 2.5kg/mm2 or less.

[0049] (Work example 2) In the work example 2, the relation of the hardness of the polisher of a scouring pad and peripheral edge part form which are used when grinding the main surface of a glass substrate was investigated. The relation between the hardness of a polisher and a Roll-Off value is shown in drawing 5 and Table 3. In addition, the substrate of the diameter of 3.5 inch was used, R3 point was provided in the position of 1mm inside from the side wall side 4, and the amount r of gaps from the datum level in R3 point was made into the Roll-Off value (drawing 2). Moreover, it presupposed that the abrasive powder amount of supply and pressurization face pressure are constant, and the number of samples was made into 100 sheets. Drawing 5 and Table 3 show that peripheral edge part form of the glass substrate after polish does not change into the state of ** to the main surface of a glass substrate in the bottom of a field by less than 60 hardness. Moreover, it turns out that there is a tendency for the bottom of a field to become ****** as hardness is hardened. therefore, [change / by carrying out chemical strengthening treatment / when carrying out chemical strengthening of the glass substrate / Ski-jump variation / towards plus] In order to make end form of a glass substrate good It turns out that the hardness of the polisher which the bottom of a field must change into the state of ** to the main surface of a glass substrate, and is used at a polish process must make end form of the glass substrate before chemical strengthening treatment (i.e., the polish process back) 60 (Asker-C) or more. As hardness of the polisher used at a polish process, it is desirable to consider it as hardness 60-80 (Asker-C) and the hardness 66-80 (Asker-C) which serves as a Roll-Off tendency on the average preferably.

[0050]

[Table 3]

Asker-C	54	58	60	64	66	68	70	80
平均値*	0.244	0.194	0.06	0.03	-0.08	-0.113	-0.159	-0.280
最大値	0.419	0.338	0.15	0.096	0.15	0.005	-0.010	-0.008
最小値	0.103	0.033	-0.08	-0.042	-0.3	-0.255	-0.259	-0.389

*：試料100枚の平均

[0051] (Work example 3) In the work example 3, the glass substrate for magnetic disks and the magnetic disk were produced.

(1) First, the direct press of the melting glass was carried out as rough wrapping ** using the punch, the

bottom part, and the barrel type, and it obtained the glass substrate which consists of diameter 96.0mmphi and 1.8-mm-thick disc-like alumino silicate glass. In addition, in this case, in addition to a direct press, it may start with a grinding wheel from the sheet glass formed with the down draw method or the float glass process, and a disc-like glass substrate may be obtained. As alumino silicate glass, in addition, 2:58 to 75 weight % of SiO(s), Al2O3: 5-23 weight %, Li2O:3-10 weight %, Na2O : The glass for chemical strengthening which contains 4 to 13 weight % as the main ingredients (For example, the alumino silicate glass which 2:6.0 weight % of ZrO(s), 2O3:0.4 weight % of Sb(s), and 2O3:0.1 weight % of As(es) contain 2:63.5 weight % of SiO(s), Al2O3:14.2 weight %, Na2O:10.4 weight %, and Li2O:5.4weight %) was used. Subsequently, the lapping process was given to the glass substrate. This lapping process aims at improvement in dimensional accuracy and accuracy of form. The lapping process was performed using wrapping equipment and performed the grain size of the abrasive grain by #400. By using the alumina abrasive grain of grain size **400 first, setting Load L as about 100kg in detail, and rotating an adduction reduction gear and an abduction reduction gear Both sides of the glass substrate stored in the carrier were wrapped at the profile irregularity of 0-1 micrometer, and 6 micrometers (it measures by JISB0601) of surface roughness (Rmax) grade.

[0052] (2) While opening the pore in the center portion of a glass substrate using the form processing process, next the cylindrical grinding stone, after also grinding the peripheral end face and setting a diameter to 95mmphi, predetermined beveling processing was performed to the peripheral end face and the inner circumference end face. The surface roughness of the glass substrate end face at this time was about 4 micrometers in Rmax.

[0053] (3) [end-face ********** / with brushing using slurry (cerium oxide abrasive grain)] subsequently A peripheral end face (side wall side) the surface roughness of the peripheral end face of a glass substrate, and an inner circumference end face, rotating a glass substrate Rmax=0.17micrometer, Ra = in Rmax=0.77micrometer, Ra=0.10micrometer, and an inner circumference end face (side wall side), 0.02 micrometer ground, and, in the peripheral end face (chamfering-of-the-edge side), Rmax=0.17micrometer, Ra=0.02micrometer, and an inner circumference end face (chamfering-of-the-edge side) ground to to Rmax=0.60micrometer and Ra=0.08micrometer. In addition, Rmax and Ra were measured by the product made by TencorP2:KLA-Tenkor. Water washing of the glass substrate which finished the above-mentioned end-face mirror-surface-finish process was carried out.

[0054] (4) About 2 micrometers and Ra set flatness of 3 micrometers, and surface roughness to about 0.2 micrometer by Rmax by changing a lapping process, next the grain size of an abrasive grain into #1000, and wrapping the glass substrate surface. In addition, Rmax and Ra were measured by AFM (atomic force microscope). The glass substrate which finished the above-mentioned lapping process was immersed in each cleaning tank of neutral detergent and water one by one, and was washed.

[0055] (5) The polishing process, next the polishing process were given. This polishing process aims at clearance of the blemish which remained by the lapping process mentioned above, or distortion, and was performed using polish equipment. The polisher which uses change of the end form of a substrate at a

polishing process here (scouring pad), It is greatly dependent on conditions, such as processed surface pressure, and the amount (Ski-jump variation: 0.004 micrometer) from which peripheral edge part form changes on the chemical-strengthening conditions (340 degree-Cx2hr) acquired by the previous work example 1 is expected. The board edge part form after a polishing process ground by selecting the polishing conditions which become about Ski-jump value =0micrometer and about Roll-Off value = abbreviation-0.004micrometer. In addition, the Ski-jump value and the Roll-Off value were measured on the same conditions as work examples 1 and 2. The polish conditions are as follows.
Grinding liquid: Cerium oxide (mean particle diameter of 1.0 micrometers) (loose abrasive + water)
Polisher: Elasticity polisher (hardness 68 (Asker-C))
Processing pressure: 200kg (planar pressure: 66g/cm2)
polish time: -- amount of 80min clearances: -- 50-micrometer upper lapping plate ******: -- number of 20rpm lower lapping plate rotations: -- ******(revolution): of a 26rpm carrier -- rotational frequency [of a 3rpm carrier] (rotation): -- [the glass substrate which finished the 3rpm above-mentioned polishing process] It was immersed in each cleaning tank of neutral detergent, pure water, pure water, and IPA (isopropyl alcohol) and IPA (steamy dryness) one by one, and went to it. When the peripheral edge part form of the obtained substrate was measured with the surface roughness measuring instrument (surfboard test SV-624: made by MITTOYO), it is Ski-jump value =+0.002micrometer and Roll-Off value =-0.005micrometer, and the peripheral edge part form of ****** was acquired for the bottom of a field a little to the main surface.
[0056] (6) Chemical strengthening was performed to the glass substrate which finished the chemical-strengthening process, next the cleaning process. Chemical strengthening prepared for the chemical-strengthening-treatment tub the chemical-strengthening solution which mixed potassium nitrate (60%) and sodium nitrate (40%), heated this chemical-strengthening solution at 340 degrees C, immersed the washed glass substrate preheated by 300 degrees C for 2 hours, and was performed. The glass substrate which completed the above-mentioned chemical strengthening was immersed in the 20-degree C cistern, was quenched, and was maintained for about 10 minutes. Thereby, the inferior goods containing a minute crack are removable. The glass substrate which finished the above-mentioned chemical-strengthening process was immersed in each cleaning tank of sulfuric acid of 10 weight % of concentration, neutral detergent, pure water, pure water, and IPA one by one, and was washed.
[0057] The place which measured the peripheral edge part form of the glass substrate "pass the above-mentioned process", Ski-jump value =+0.002micrometer, a Roll-Off value = It is set to +0.005 micrometer and the main surface is further made into a datum level in the field from a point R2 to R3. The good value which falls within the range (-0.005 micrometer - +0.005 micrometer) of **0.005 micrometer was shown, and the glass substrate after the chemical strengthening treatment which has an almost flat substrate peripheral edge part was obtained. In addition, the value of 79.8 micrometers and compressive stress of the depth of the compressive stress layer of the glass substrate obtained after this chemical strengthening treatment was the same as the value which the value of 13.8kg/mm2 and tensile stress became 2.0kg/mm2, and was shown by the sample 1-2 of Table 1. Moreover, the surface roughness (Ra, Rmax) of the glass substrate

main surface, the surface wave Wa, And when the surface wave (minute wave) (Ra) Wa in the infinitesimal area in a substrate peripheral edge part was measured, they were Ra=0.51nm, Rmax=5.20nm, Wa(Ra) =0.50nm, and Wa=0.43nm. In addition, surface roughness Ra and Rmax are AFM(s) (atomic force microscope), and [the surface wave (minute wave) (Ra) Wa in an infinitesimal area] By measurement by multifunctional surface analysis equipment (made by MicroXAM:PHASE SHIFT TECHNOLOGY), the surface wave Wa was measured with the multifunctional disk interferometer (made by OPTIFLAT:PHASE SHIFT TECHNOLOGY), respectively. The measurement conditions of the surface wave (minute wave) (Ra) Wa in an infinitesimal area and the surface wave Wa and the definition are as follows. The surface wave (minute wave) (Ra) Wa in an infinitesimal area and the surface wave Wa scan the predetermined region of a substrate side using white light etc., the reflected light from a substrate side and the reflected light from a datum level are compounded, and a surface wave is calculated by the interference fringe produced at the synthesized point. The cycles of a wave are 2 micrometers - about 4 micrometers, and the surface wave (minute wave) (Ra) Wa in an infinitesimal area points out the average of the absolute value of the deflection from a center line to a measurement curve. Here, when a straight line parallel to the average line of a measurement curve is drawn, the area surrounded with this straight line and a measurement curve calls a center line the straight line which are the both sides of this straight line and becomes equal. The surface wave (minute wave) (Ra) Wa in an infinitesimal area is a value expressed with the following formulas (1).
[0058]
[Mathematical formula 1]

$$Wa(Ra) = \frac{1}{n}\sum_{i=1}^{n}\left| Xi - \bar{X} \right| \qquad (1)$$

[上記式（1）中，Xiは、測定ポイントにおける測定ポイント値（測定ポイントにおいてある基準線から測定曲線までの高さ、$\bar{X}$は、上記測定ポイント値の平均値、nは、測定ポイント数、をそれぞれ示す。]

[0059] In addition, the surface wave (minute wave) (Ra) Wa in the above-mentioned infinitesimal area is the value measured in the square area (about 500 micrometers x about 600 micrometers) (about 250000 pixels). The cycle of a wave is the thing of a comparatively big crest (trough) compared with 300 micrometers - about 5 micrometers, and the cycle of the surface wave Wa in the above-mentioned infinitesimal area (Ra), and the surface wave Wa points out the average of the absolute value of the deflection from a center line to a measurement curve. The definition of a center line is the same as the above. The surface wave Wa is a value expressed with the following formulas (2).
[0060]
[Mathematical formula 2]

$$Wa = \frac{1}{N} \sum_{I=1}^{N} \left| XI - \bar{X} \right| \qquad (2)$$

[上記式（２）中、ＸＩは、測定ポイントにおける測定ポイント値（測定ポイントにおいてある基準線から測定曲線までの高さ、$\bar{X}$は、上記測定ポイント値の平均値、Ｎは、測定ポイント数、をそれぞれ示す。]

[0061] In addition, the value of the above-mentioned surface wave Wa is a value measured from the center of the substrate in the range (about 115400 pixels) r= 20.3-45.0mm in radius.

[0062] (7) [the process which carried out magnetic-disk manufacturing process **** / both sides of the glass substrate for magnetic disks pass] Using the in-line type sputtering system, the NiAl seed layer, the CrMo foundation layer, the CoCrPtTa magnetic layer, and the hydrogenation carbon protective layer were formed one by one, with the dip method, the perfluoro polyether fluid lubrication layer was formed and the magnetic disk for LUL (load unloading) methods was obtained. Although this obtained magnetic disk was carried in HDD (hard disk drive) of the LUL method, the head crash by peripheral edge part form (the bottom of upheaval or a field is **) was not generated, but the floatation stability of the magnetic head was good. Moreover, since surface roughness (Ra, Rmax), the surface wave Wa, and the surface wave (minute wave) (Ra) Wa in the infinitesimal area were all good (a value is small), the touch-down height also showed 10nm or less and a good value, and they did not cause a head crash. Moreover, amplification of recording area was able to be aimed at.

[0063] (Comparative example 1) especially in the above-mentioned polishing process, a unite lump of peripheral edge part form was not performed (a page -- it falls and is not made feeling), but the glass substrate for magnetic disks and the magnetic disk were produced like the work example 3 except having set chemical-strengthening-treatment conditions to 380 degree-Cx4hr. As a result, although the surface roughness of the glass substrate main surface was comparable as the work example 3, it was set to Ski-jump=+0.421micrometer and Roll-Off=+0.420micrometer, and the head crash by end form occurred. In addition, the value of 140.8 micrometers and compressive stress of the depth of the compressive stress layer of the glass substrate obtained after chemical strengthening treatment was the same as the value which the value of 20.5kg/mm2 and tensile stress became 2.7kg/mm2, and was shown in the sample 1-7 of Table 1. In addition, when the surface wave Wa (Ra) and the surface wave Wa in the infinitesimal area in a substrate peripheral edge part were measured, they were Wa(Ra) =0.93nm and Wa=1.85nm.

[0064] [result / of a work example 3 and a comparative example 1 / a work example 3] The chemical-strengthening-treatment conditions which determined chemical-strengthening-treatment conditions and were searched for above within limits which satisfy the mechanical endurance required of the glass substrate for magnetic disks, From a correlation with the amount of end shape changes of a glass substrate, the variation of the end form caused by chemical-strengthening-treatment conditions is expected. [the end form before chemical strengthening treatment / making predetermined end form by double lump of a polish process etc.] [even if carried in HDD (hard disk drive) of a LUL method, the glass substrate for magnetic disks and

magnetic disk which become do not generate but good / the head crash by peripheral edge part form (the bottom of upheaval or a field is **) / the floatation stability of a magnetic head / are obtained, but] When not performing a double lump like a comparative example 2, it turns out that the glass substrate for magnetic disks and a magnetic disk applicable to a LUL method are not obtained. The result of a work example 3 and a comparative example 1 shows that a Ski-jump value, the surface wave Wa, and Wa (Ra) become large as the shape change of the peripheral end face by chemical strengthening treatment becomes large (as chemical-strengthening-treatment conditions become strong).

[0065] (Work example 4) The glass substrate for magnetic disks and magnetic disk for CSS methods were produced like the work example 3 except having added Kay fluoric acid processing to the washing processing process after a polishing process in the above-mentioned work example 3. As a result, peripheral edge part form (a Ski-jump value, Roll-Off value) is comparable. The surface roughness of the glass substrate main surface was set to Rmax=7.8nm and Ra=0.83nm by Kay fluoric acid processing, and the head crash by peripheral edge part form was not generated, but the floatation stability of the magnetic head was good. Moreover, amplification of recording area was able to be aimed at.

[0066] (Work example 5) in the above-mentioned work example 3 in order to apply the chemical-strengthening-treatment conditions of 380 degree-Cx 4 hours at a chemical-strengthening process The amount (Ski-jump variation: 0.035 micrometer) from which peripheral edge part form changes on the chemical-strengthening-treatment conditions (380 degree-Cx 4 hours) acquired by the previous work example 1 is expected. The end form of the substrate after a polishing process produced the glass substrate for magnetic disks, and the magnetic disk like the work example 3 except having ground by selecting the polishing conditions which become about Ski-jump value =0micrometer and about Roll-Off value = abbreviation-0.035micrometer. In addition, as polish conditions, the hardness of the polisher used the thing of 80 (Asker-C), and other polish conditions, such as a processing pressure and polish time, ground by adjusting suitably. As a result, when the peripheral edge part form of the obtained substrate was measured, it is Ski-jump value =+0.03micrometer and Roll-Off value =-0.04micrometer, and peripheral edge part form got worse as compared with the work example 3. Although this obtained magnetic disk was carried in HDD (hard disk drive) of the LUL method, the head crash by peripheral edge part form (the bottom of upheaval or a field is **) was not generated, but the floatation stability of the magnetic head was good. Moreover, amplification of recording area was able to be aimed at. This is considered that the variation of the peripheral edge part form by chemical strengthening treatment was [to control exact end form] too large. In addition, when two or more glass substrates were produced on condition of the work example 3 and the work example 5 and end form was measured, it has checked that there was less work example 3, end-shaped dispersion was stabilized in it, and a glass substrate with good end form was obtained.

[0067] In addition, this invention is not limited to the work example mentioned above.

[0068] For example, this invention is applicable not only like the peripheral edge part of a glass substrate but control of the form of an inner circumference end.

[0069] Moreover, as chemical-strengthening conditions for controlling peripheral edge part form and/or inner

circumference end form, cooking temperature and not only immersion time but the kinds (for example, mixing ratio of potassium nitrate and sodium nitrate etc.) of chemical-strengthening-treatment solution can adjust. moreover -- as the kind of chemical-strengthening-treatment solution -- not only the mixed salt of potassium nitrate and sodium nitrate but potassium nitrate -- independent salt and sodium nitrate -- fused salt, such as independent salt, and Na2SO4, K2SO4, NaBr, KBr, KNO2, NaNO2, can be used.

[0070] furthermore, as a means for controlling peripheral edge part form and/or inner circumference end form Although chemical strengthening treatment was mentioned, board edge part form not only this but after a polishing process is carried out with some upheaval a little, and the bottom of a field is possible also for controlling peripheral edge part form and/or inner circumference end form by [of ******] processing (for example, dealkalization processing) to this glass substrate.

[0071] This invention can be applied also when performing the main surface polish processing after chemical strengthening treatment. In this case, what is necessary is just to choose each processing condition in consideration of change of the peripheral edge part form in each processing, and/or inner circumference end form, so that desired peripheral edge part form and/or inner circumference end form may be acquired.

[0072] It cannot be overemphasized that the glass substrate for Information Storage Division media of this invention is applicable not only to the glass substrate for magnetic disks but the glass substrate for optical discs, the glass substrate for magneto-optical discs, etc.

[0073]

[Effect of the Invention] According to the production method of the glass substrate for Information Storage Division media of this invention etc., the glass substrate after the chemical strengthening treatment which has desired peripheral edge part form and inner circumference end form can be obtained. Moreover, according to the Information Storage Division medium of this invention etc., it is possible to have sufficient smoothness for a grade recordable high-density, and to expand recording area even to a periphery, having the mechanical endurance by chemical strengthening.

[Translation done.]